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Theory of Operation and Technical Description OF Teledyne RD Instruments' Sentinel V 2.4 GHz IEEE 802.11b/g/n Interface

Document Number
TRDI.WP.413252 Rev C
1/23/2013

The operation of the IEEE 802.11b/g/n interface of the Sentinel V ADCP is described.

1.0 Purpose

The theory of operation and the technical description of the 2.4 GHz IEEE 802.11b/g/n interface circuitry of the Sentinel V ADCP are presented and described.

2.0 Scope

This document describes the basic data path and radiation characteristics of the 2.4 GHz IEEE 802.11b/g/n interface circuitry of the Sentinel V ADCP, from the raw data generated by the device to the RF antenna. Technical information in this document is applicable to the device's hardware and firmware design as of February 20, 2013.

3.0 Theory of Operation

The device communicates bi-directionally via a wireless local access network (WLAN) with external devices. The raw data generated by the device is first packetized according to the TCP/IP protocol by an onboard microprocessor, sent to a commercial IEEE 802.11b/g/n interface module for conversion to the 2.4GHz RF band (industrial, scientific, and medical), and then radiated via a commercial 2.4GHz antenna. IEEE 802.11b/g/n compatible data from the WLAN is likewise received by the antenna, demodulated by the IEEE 802.11b/g/n interface module to TCP/IP, and the packets sent to the device's microprocessor for conversion to raw data. The device is initially configured for the n version of the protocol, but can negotiate down to interface with g and b versions if needed.

4.0 Technical Description

The following sections detail the data flow and the associated hardware.

4.1 Transmission

The device both transmits and receives IEEE 802.11b/g/n wireless interface data. The first section describes the device as a transmitter.

4.1.1 Data Generation & TCP/IP Conversion

The device generates raw data which is converted to TCP/IP packets by a microprocessor.

4.1.2 Data 802.11b/g/n Interface Conversion

The packetized data is then sent to the Taiyo Yuden WYSBCVGXA WLAN module over a Secure Data Input/Output (SDIO) link. This module comprises the Marvell 88W8787 Avastar WLAN System-on-a-chip, a crystal oscillator (38.4 MHz), an EEPROM, an RF switch, a power amplifier, and a band-pass filter. Upon connection with the external device, the module

negotiates to the n, g, or b version of the standard, in that order. The module then modulates the packetized data to the appropriate IEEE 802.11b/g/n protocol, and transmits it at a maximum data rate of 72.2Mbps on a carrier frequency of 2.4GHz. Although IEEE 802.11b/g/n allows for MIMO (multiple-input multiple-output) implementations, this device has only one antenna.

The WYSBCVGXA is capable of using channels 1 to 13. The specific channel used is determined by firmware. Channel 6 at a bandwidth of 20MHz is set by default.

4.1.3 Conversion to 802.11b/g/n interface RF

After modulation to electrical IEEE 802.11b/g/n interface, the signal is sent to a Taoglas high performance magnetic field antenna in a low profile SMT package, PN FXP70.07.0053A, and is radiated out of the device.

4.2 Reception

The device also acts as a receiver. The data path is the direct converse of the transmission path as is described in the previous sections.

4.3 Emission Enabling

The device's RF emission enabling is controlled by system timeout functions. An external touch sensor enables the wireless circuitry upon activation. The device will perform a system timeout automatically two minutes after the sensor's activation if no activity is detected, disabling the wireless circuitry. If the device is linked to Teledyne RD Instruments' "Ready V" software via the WLAN, a longer system timeout is set during data file downloads to the external device, according to the file size. After this timeout period, the system reverts back to the two minute default.